

What is claimed is:

1. A process for producing a hyaluronan (HA) ester, the process comprising the steps of:
  - (a) performing a silylation reaction on an HA-quaternary ammonium complex; and
  - (b) performing an acylation reaction on the silyl HA-quaternary ammonium complex using an acid chloride.
2. The process of claim 1 wherein:
  - (a) the step of performing a silylation reaction comprises silyating an HA-cetyltrimethyl ammonium salt complex, HA-CTA, producing a silyl HA-cetyltrimethyl ammonium salt complex; and
  - (b) the step of performing an acylation reaction comprises introducing the acid chloride having been selected from aliphatic acyl groups consisting of: Hexanoyl,  $\text{CH}_3(\text{CH}_2)_4\text{COCl}$ ; Octanoyl,  $\text{CH}_3(\text{CH}_2)_6\text{COCl}$ ; Decanoyl,  $\text{CH}_3(\text{CH}_2)_8\text{COCl}$ ; Lauroyl,  $\text{CH}_3(\text{CH}_2)_{10}\text{COCl}$ ; Palmitoyl,  $\text{CH}_3(\text{CH}_2)_{14}\text{COCl}$ ; and Stearoyl,  $\text{CH}_3(\text{CH}_2)_{16}\text{COCl}$ .
3. The process of claim 2 further comprising the step of shaping the hyaluronan (HA) ester by applying thermal energy to melt-process the ester into a structure-shape.
4. The process of claim 2 further comprising the steps of:
  - (a) shaping the hyaluronan (HA) ester into a structure-shape; and
  - (b) performing a saponification substantially removing acyl groups,  $\text{CH}_3(\text{CH}_2)_N\text{CO}$ , and the cetyltrimethyl ammonium salt groups, -CTA, from the hyaluronan (HA) ester to produce a regenerated HA.
5. The process of claim 4:
  - (a) wherein the step of shaping the hyaluronan (HA) ester comprises further processing the ester into the structure-shape selected from the group consisting of: a plurality of polymer fibers; a generally solid bulk structure; and porous bulk structure, the pores of which are thereafter seeded with animal cells; and
  - (b) further comprising, after the step of performing a saponification, the step of crosslinking the regenerated HA.

6. The process of claim 1:
- (a) wherein the step of performing a silylation reaction comprises silylating an HA-cetyltrimethyl ammonium salt complex, HA-CTA, producing a silyl HA-cetyltrimethyl ammonium salt complex; and
  - (b) further comprising the step of performing a saponification substantially removing acyl groups and the cetyltrimethyl ammonium salt groups, from the hyaluronan (HA) ester to produce a regenerated HA.
7. The process of claim 1:
- (a) wherein the step of performing an acylation reaction comprises introducing the acid chloride having been selected from aliphatic acyl groups consisting of: Hexanoyl,  $\text{CH}_3(\text{CH}_2)_4\text{COCl}$ ; Octanoyl,  $\text{CH}_3(\text{CH}_2)_6\text{COCl}$ ; Decanoyl,  $\text{CH}_3(\text{CH}_2)_8\text{COCl}$ ; Lauroyl,  $\text{CH}_3(\text{CH}_2)_{10}\text{COCl}$ ; Palmitoyl,  $\text{CH}_3(\text{CH}_2)_{14}\text{COCl}$ ; and Stearoyl,  $\text{CH}_3(\text{CH}_2)_{16}\text{COCl}$ ; and
  - (b) further comprising the step of shaping the hyaluronan (HA) ester into a structure-shape while crosslinking the hyaluronan (HA) ester.
8. A process for producing a hyaluronan (HA) ester, the process comprising the steps of:
- (a) performing a silylation reaction on an HA-cetyltrimethyl ammonium salt complex, HA-CTA; and
  - (b) performing an acylation reaction on the silyl HA-cetyltrimethyl ammonium salt complex using an acid chloride selected from the group consisting of: Hexanoyl,  $\text{CH}_3(\text{CH}_2)_4\text{COCl}$ ; Octanoyl,  $\text{CH}_3(\text{CH}_2)_6\text{COCl}$ ; Decanoyl,  $\text{CH}_3(\text{CH}_2)_8\text{COCl}$ ; Lauroyl,  $\text{CH}_3(\text{CH}_2)_{10}\text{COCl}$ ; Palmitoyl,  $\text{CH}_3(\text{CH}_2)_{14}\text{COCl}$ ; and Stearoyl,  $\text{CH}_3(\text{CH}_2)_{16}\text{COCl}$ .
9. The process of claim 8 further comprising the step of:
- (a) shaping the hyaluronan (HA) ester into a structure-shape selected from the group consisting of: a plurality of polymer fibers; a generally solid bulk structure; and porous bulk structure; and
  - (b) performing a saponification substantially removing acyl groups and the cetyltrimethyl ammonium salt groups, from the hyaluronan (HA) ester to produce a regenerated HA.
10. A hyaluronan (HA) ester produced from an acylated silyl HA-cetyltrimethyl ammonium salt complex, wherein an acylation agent is used in producing the complex and comprises an acid chloride selected from the group consisting of: Hexanoyl,

$\text{CH}_3(\text{CH}_2)_4\text{COCl}$ ; Octanoyl,  $\text{CH}_3(\text{CH}_2)_6\text{COCl}$ ; Decanoyl,  $\text{CH}_3(\text{CH}_2)_8\text{COCl}$ ; Lauroyl,  $\text{CH}_3(\text{CH}_2)_{10}\text{COCl}$ ; Palmitoyl,  $\text{CH}_3(\text{CH}_2)_{14}\text{COCl}$ ; and Stearoyl,  $\text{CH}_3(\text{CH}_2)_{16}\text{COCl}$ .

11. The hyaluronan (HA) ester of claim 10 crosslinked and shaped into a structure-shape selected from the group consisting of: a plurality of polymer fibers; a generally solid bulk structure; and porous bulk structure.

12. The hyaluronan (HA) ester of claim 10 shaped into a structure-shape that is saponified into a regenerated HA form; the structure-shape integrated with a component.

13. A structure-shape comprising hyaluronan (HA) that has been returned to a regenerated HA state by saponification of a melt-processable hyaluronan (HA) ester; the melt-processable hyaluronan (HA) ester having been first produced from an acylated silyl HA-cetyltrimethyl ammonium salt complex; wherein an acylation agent comprising an acid chloride, was used in producing the acylated silyl HA-cetyltrimethyl ammonium salt complex.

14. The structure-shape of claim 13 shaped by applying thermal energy to melt-process the hyaluronan (HA) ester into the structure-shape selected from the group consisting of: a plurality of polymer fibers; a generally solid bulk structure; and porous bulk structure; and wherein the acid chloride is selected from the group consisting of: Hexanoyl,  $\text{CH}_3(\text{CH}_2)_4\text{COCl}$ ; Octanoyl,  $\text{CH}_3(\text{CH}_2)_6\text{COCl}$ ; Decanoyl,  $\text{CH}_3(\text{CH}_2)_8\text{COCl}$ ; Lauroyl,  $\text{CH}_3(\text{CH}_2)_{10}\text{COCl}$ ; Palmitoyl,  $\text{CH}_3(\text{CH}_2)_{14}\text{COCl}$ ; and Stearoyl,  $\text{CH}_3(\text{CH}_2)_{16}\text{COCl}$ .

15. The structure-shape of claim 13 shaped by applying pressure to the ester; wherein the structure is selected from the group consisting of: a plurality of polymer fibers; a generally solid bulk structure; and porous bulk structure.